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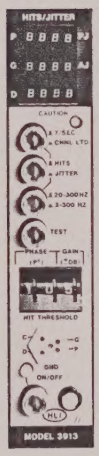
# OPERATING MANUAL
# MODEL 3913
# HITS/JITTER MODULE

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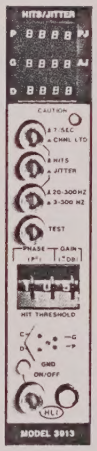


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# OPERATING MANUAL
# MODEL 3913 HITS/JITTER MODULE

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FIGURES

1. Model 3913 HITS/JITTER Module. . 1

## 1. GENERAL

**1.01** This manual contains information for operating the Model 3913 HITS/JITTER Module in conjunction with the Model 3900 COMMUNICATIONS TEST SYSTEM Basic Unit. This section contains a description and specifications for the Model 3913. Figure 1 shows the front panel.

**Figure 1. Model 3913 HITS/JITTER Module**

### A. Functional Description

**1.02** The Model 3913 measures and displays phase hits, gain hits, dropouts, phase jitter and amplitude jitter. The module is designed to meet Bell PUB 41009 specifications and comply with CCITT Rec. O.91. Phase and amplitude jitter may be measured with the standard weighting of 20 - 300 Hz or an extended low-frequency weighting of 3 Hz - 300 Hz. The jitter signals are made available on a barrier strip mounted on the rear of the Model 3900 Basic Unit and may also be displayed on the Model 3980 CRT DISPLAY Module for a visual representation of channel impairments. Hit thresholds are front panel selectable and either Bell Standard or channel-limited count rates may be selected. The hit measurements are interlocked with the dropout detector and the Model 3911 IMPULSE NOISE Module in accordance with Bell PUB 41009. The impulse noise lockout is optional on the Model 3920 IMPULSE NOISE Module (CCITT Rec. O.71).

### B. Specifications

**1.03** Specifications for the Model 3913 are contained in Table A.

## TABLE A. MODEL 3913 SPECIFICATIONS

| | |
|---|---|
| OPERATING MODES | |
| Hits: | Phase Hits<br>Gain Hits<br>Dropouts |
| Jitter: | Phase Jitter<br>Amplitude Jitter |
| RECEIVE HOLDING TONE (All Measurements) | |
| Frequency Range | 990 Hz to 1030 Hz |
| Level Range | +10 dBm to −40 dBm |
| PHASE JITTER | |
| Measurement Range | 0.0° to 30.0° peak-to-peak |
| Accuracy | ±5% of reading, ±0.2° |
| Weighting | Bell Standard (20 Hz - 300 Hz)<br>Bell Standard + LF (3 Hz - 300 Hz) |
| AMPLITUDE JITTER | |
| Measurement Range | 0.0% to 30.0% peak |
| Accuracy | ±5% of reading, ±0.2% |
| Weighting | Bell Standard (20 Hz - 300 Hz)<br>Bell Standard + LF (3 Hz - 300 Hz) |
| PHASE HITS | |
| Measurement Range | 5° to 50°, peak, in 5° steps |
| Guard Interval | 4 ms |
| Count Capacity | 9999 maximum |
| GAIN HITS | |
| Measurement Range | ±1 to ±10 dB, in 1 dB steps |
| Guard Interval | 4 ms |
| Count Capacity | 9999 maximum |
| DROPOUTS | |
| Dropout Range | Greater than or equal to 12 dB |
| Accuracy | ±1.0 dB |
| Guard Interval | 4 ms |
| Count Capacity | 9999 maximum |
| Response to Noise | Per Bell PUB 41009 |
| HIT/IMPULSE INTERLOCK | When used with Model 3911 IMPULSE NOISE Module, impulse noise counts are interlocked with hit and dropout occurrences in accordance with Bell System specifications.<br>When used with Model 3920 IMPULSE NOISE Module (CCITT Rec. O.71), interlock is optional. |
| DIGITAL DISPLAYS | Phase/Amplitude Jitter<br>Phase/Gain Hits and Dropouts |
| OVERRANGE INDICATION | Displays flash when maximum count (hits) or range (jitter) is exceeded. |
| EXTERNAL JITTER ANALOG OUTPUTS | |
| Impedance | 2 kΩ |
| Level | 100 mV/degree for phase jitter<br>100 mV/% for amplitude jitter |

TABLE A. MODEL 3913 SPECIFICATIONS (Cont.)

| | |
|---|---|
| EXTERNAL HIT LOGIC OUTPUTS (Front Panel Connector) | |
| Impedance | 10 kΩ |
| Level | No hit = 0 V dc<br>Hit = +5 V dc |
| EXTERNAL DEMODULATED CARRIER OUTPUT | |
| Impedance | 10 kΩ |
| Level | 12 V peak-to-peak square wave |
| CONNECTOR TYPE | Positronic #GH5F, or equal |
| SELF-TEST | Pushing test button applies a known jitter signal to the module input and Basic Unit generator output. |
| TIMER | 5 min., 15 min., continuous; located in the Basic Unit |
| GENERATOR | Holding tone supplied by Basic Unit generator |
| MODULE INTERLOCKS | "Exclusive Measurement" interlock |
| INDICATORS | CAUTION<br>Module ON |
| MODULE SIZE | Single-width module, |
| MODULE WEIGHT | 34 oz. (1 Kg.) |

HLI reserves the right to make changes in specifications at any time without notice.

## 2. OPERATING INSTRUCTIONS

**2.01** This section contains the setup procedures for the Model 3913 and related setup procedures for the Basic Unit. Features of the Model 3913 are also described.

### A. Setup Procedures for Basic Unit

**2.02** To set up the Basic Unit for hits/jitter measurements, proceed as follows:

1) Set the ABS/REL switch to ABS.
2) Select REC LEVEL.
3) Set the REL REF thumbwheel switches to match the LEVEL display reading. This sets the Model 3913 dropout threshold to the correct level.
4) Set the desired timer interval for hit measurements.
5) Set the NORM/RETURN LOSS switch to NORM.
6) Select either ABS or REL as desired for measurement of received signal.
7) Select either REC LEVEL or NOISE as desired.
8) For generator setup, refer to Sections 8 and 9 of Basic Unit Operating Manual, (3901-M20).
9) For line interface, refer to Section 4 of Basic Unit Operating Manual (3901-M20).

### B. Setup Procedures for Hit Measurements

**2.03** In this mode of operation, the Model 3913 will count and display phase hits, gain hits, and dropouts. Outputs are provided on the Model 3913 front panel connector for hit events.

**2.04** In order to measure hits, proceed as follows:

1) Set up the Basic Unit as described in Paragraph 2.02.
2) Turn the Model 3913 on by momentarily pressing the Model 3913 ON/OFF switch.
3) Select the desired counting rate of 7/SEC or CHNL LTD.
4) Set the HIT THRESHOLD thumbwheel switches to the desired phase hit and gain hit threshold.
5) Set the HITS/JITTER switch to HITS.
6) Start the timer by momentarily pressing the START/STOP switch of the Basic Unit timer. When the timer times out, the measurement will stop.
7) In CONT mode only, momentarily press timer START/STOP to stop measurement after desired time interval.
8) The Model 3913 simultaneously measures hits and jitter. To display the current jitter readings, set the HITS/JITTER switch to JITTER and select desired jitter weighting (20 - 300 Hz or 3 - 300 Hz).
9) To turn the Model 3913 off, momentarily press the ON/OFF switch. Turning on a conflicting module or selecting RETURN LOSS mode will also turn the Model 3913 off.

### C. Setup Procedures for Jitter Measurements

**2.05** In this mode of operation, the Model 3913 will measure and display phase jitter and amplitude jitter with either the Bell Standard weighting of 20 - 300 Hz or the extended low-frequency weighting of 3 - 300 Hz. Demodulated jitter analog signals are available at the Basic Unit rear panel. Refer to Basic Unit Operating Manual (3901-M20), Section 14, for rear panel connections.

**2.06** In order to measure phase and amplitude jitter, proceed as follows:

1) Set up the Basic Unit as described in Paragraph 2.02.
2) Turn the Model 3913 on by momentarily pressing the Model 3913 ON/OFF switch.
3) Set the HITS/JITTER switch to JITTER.
4) Select either the 20-300 Hz or 3-300 Hz weighting.
5) The Model 3913 simultaneously measures jitter and hits so that while jitter measurements are being displayed, the Model 3913 continues to collect hits when activated by the timer in the Basic Unit. To display the current hits

information, set the HITS/JITTER switch to HITS.

6) To turn the Model 3913 off, momentarily press the ON/OFF switch. Turning on a conflicting module or selecting RETURN LOSS mode will also turn the Model 3913 off.

## D. Features

**2.07** Overflow: When the occurrence of hits or dropouts exceeds the count capacity of 9999 during a measurement interval, the overflowed counter(s) will flash at a 1 Hz rate.

**2.08** Overrange: When the measured phase or amplitude jitter is beyond the measurement capacity of the Model 3913, the overranged display(s) will flash at a 1 Hz rate.

**2.09** CAUTION (LED): The CAUTION indicator will come on whenever the input signal is beyond the range of 990 Hz to 1030 Hz or when a dropout condition exists. The CAUTION indicator will stay on for the duration of a test if a test is initiated by starting the timer before the REL REF thumbwheels have been set for a reading of 0.0 dB (see Paragraph 2.02, Step 3).

**2.10** Counting Hierarchy: When a Model 3913 is used with the Model 3911 IMPULSE NOISE Module, any transient qualified as a dropout, phase hit, or a gain hit will not be counted as impulse noise, in accordance with Bell PUB 41009.

**2.11** Lamp Test: When the Model 3913 is on the Basic Unit Lamp Test switch (on rear of chassis) will turn on all segments of all displays, including LED indicators, to verify that all of the segments and indicators are functional.

**2.12** Freeze: When the Basic Unit FRZ terminal (on rear of chassis) is grounded, all display and indicator information will be preserved until the freeze is removed, even though the input signal may have been removed, or the jitter or hits readings changed during the freeze interval. Upon release of FRZ the counters will immediately indicate the current totals, including hits and dropouts that occurred during the FRZ interval.

**2.13** Test: When the Model 3913 TEST switch is pressed, a known jitter signal is generated using the 2-tone sum technique. This signal is internally connected to the Model 3913 input and the Basic Unit generator output. When the switch is pressed, the Basic Unit RMT GEN indicator is on and none of the generator function switches, with the exception of QUIET TERM, has any effect.

**2.14** External Logic Outputs: Logic level outputs are provided at the front panel connector for use with external chart recorders or event counters. In 7/sec mode of operation the outputs labeled G (gain hit) and P (phase hit) will go from ground to +5 Vdc for 143 ms when a hit occurs. The output labeled D (dropout) will go from ground to +5 Vdc for 143 ms or the duration of the dropout whichever is longer, when a dropout occurs. In the CHN LTD mode of operation the outputs labeled G (gain hit) and P (phase hit) will go from ground to +5 Vdc for the time it takes the hits circuitry to recover after a hit has occurred and the output labeled D (dropout) will go from ground to +5 Vdc for the duration of the dropout. The output labeled C (demodulated carrier) is a 12 volt peak-to-peak replica of the demodulated carrier that can be connected to an external frequency counter. The center pin labeled GND is the ground return for all front panel outputs.

## 3. SELF-TEST

**3.01** This section contains the procedure for self-testing the Model 3913.

**3.02** To perform the Model 3913 self-test, proceed as follows:

1) Turn the Model 3913 on by momentarily pressing the Model 3913 ON/OFF switch. Basic Unit must not be in RETURN LOSS mode.
2) Set the 7/SEC/CHNL LTD switch to 7/SEC.
3) Set the HITS/JITTER switch to JITTER.
4) Set the 20-300 HZ/3-300 HZ switch to 20-300 HZ.
5) Set the phase hit threshold switch to $50^{o}$.
6) Set the gain hit threshold to ±10 dB.
7) Press the TEST switch and verify that the Model 3913 reads $16.9^{o}$ $\pm0.5^{o}$ of phase jitter and 14.6% ±0.5% of amplitude jitter.
8) Set the HITS/JITTER switch to HITS.
9) Set the phase hits threshold to $5^{o}$.
10) Set the gain hits threshold to ±1 dB.
11) Start the timer by momentarily pressing the START/STOP switch of the Basic Unit timer.
12) Press the Model 3913 TEST switch and verify that $5^{o}$ phase hits and 1 dB gain hits are counted.
13) Set the phase hits threshold to $15^{o}$.
14) Set the gain hits threshold to 2 dB.
15) Press the Model 3913 TEST switch and verify that no hits are counted.

*Note:* If there is no holding tone input to the Basic Unit, a dropout will be counted each time the TEST switch is released.

## 4. INSTALLATION/REMOVAL

**4.01** This section describes the procedures for installation or removal of the module.

> **WARNING:** Before module installation or removal, make sure that Basic Unit POWER switch is OFF (out position).

**4.02** To install the module, proceed as follows:

1) Align the module's PC board with the guides of the Basic Unit slot, and push the module in until the extractor rod contacts the extractor standoff.
2) Turn the extractor screw clockwise while gently pushing the module into the edge connector.
3) Tighten the extractor screw until the module is firmly in place.
4) After the module has been installed, it is recommended that the self-test procedure described in Section 3 be performed to verify that the unit is electrically operational.

**4.03** To remove the module, proceed as follows:

1) Turn the extractor screw counterclockwise until it turns freely.
2) Remove the module by pulling it forward.

> **WARNING:** Handle the module only by top and bottom edges of the PC board.

3) See Paragraph 5.02 for packing and shipping. See Paragraph 5.03 for return to factory.

## 5. PACKING/SHIPPING, AND RETURN TO FACTORY

**5.01** This section contains directions for the packaging and shipment of the module, and special instructions for identification tagging when returning the module to HLI for servicing or repair.

### A. Packing and Shipping

**WARNING:** When the module has been extracted from the Basic Unit, handle the module by the top and bottom edges of the board only. DO NOT handle the rear edge connector. Static electricity may damage the CMOS IC's on the board(s).

**5.02** Modules shipped separately from the factory are enclosed in a special conductive envelope that protects the circuitry from static electricity. This protective envelope should be retained and used for reshipment. If the conductive envelope is not available, DO NOT wrap the module in an ordinary plastic bag or plastic sheeting. Instead, proceed as follows:

*Note:* If the module is being returned for servicing or repair, refer to Paragraph 5.03.

1) If available, cover the entire rear edge connector with conductive shorting bar.
2) Wrap the module in heavy kraft paper.
3) Insert the wrapped module in a strong shipping container. Surround the packaged module with 2 to 4 inches (5 to 10 cm) thick shock-absorbing material. (Common newspapers may be used.)
4) Mark the container: FRAGILE: DELICATE ELECTRONIC INSTRUMENT

### B. Return for Repair or Servicing

**5.03** If the module is being returned to HLI for servicing or repair, enclose the following information:

a) Type of service or repair required
b) Model and serial number of the Basic Unit and Expander Unit from which the module was extracted
c) Model and serial number of the module
d) Your return address

Retain a copy of all information for yourself and refer to your copy in any correspondence with HLI.